

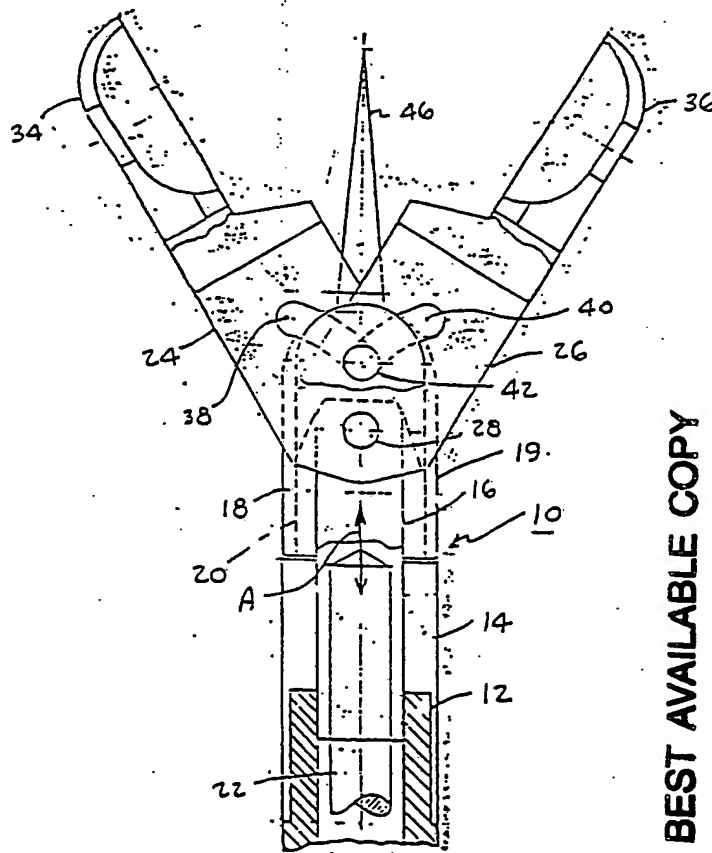
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(21) International Application Number: PCT/US89/01776 (22) International Filing Date: 27 April 1989 (27.04.89) (30) Priority data: 186,564 27 April 1988 (27.04.88) US (71) Applicant: ESCO PRECISION, INC. [US/US]; 21 William Penn Drive, Stony Brook, NY 11790 (US). (72) Inventors: ESSER, Theodor ; 21 William Penn Drive, Stony Brook, NY 11790 (US). DOHERTY, Thomas, Edward ; 7 Carriage Lane, Setauket, NY 11733 (US). (74) Agent: SCOTT, Anthony, C.; Scully, Scott, Murphy & Presser, 400 Garden City Plaza, Garden City, NY 11530 (US).			(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent). Published <i>With international search report.</i>

(54) Title: ENDOSCOPIC BIOPSY FORCEPS DEVICE

(57) Abstract

An endoscopic biopsy forceps (10) device incorporating a novel and unique camming arrangement for selectively opening and closing the biopsy cutting jaws (34, 36) of the biopsy forceps (10) which will render the entire device of a simpler construction and reliable in operation, while concurrently making it considerably less expensive to produce.



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ENDOSCOPIC BIOPSY FORCEPS DEVICE

The present invention relates to biopsy forceps and, more particularly, relates to an endoscopic biopsy forceps device incorporating a novel and unique camming arrangement for selectively opening and closing the biopsy cutting jaws of the biopsy forceps which will render the entire device of a simpler construction and reliable in operation, while concurrently making it considerably less expensive to produce.

Although varied types of biopsy forceps are currently in widespread use, such as in conjunction with endoscopic purposes, these are generally of complicated constructions necessitating the manufacture and assembly of numerous, highly precise components and, as a consequence, are quite expensive. Ordinarily, an endoscopic biopsy forceps device must be sterilized in strict compliance with rigid medical standards after each use thereof with a patient, so as to enable the device to again be safely employed with another patient for subsequent medical and/or surgical endoscopic biopsy procedures. Such sterilizing procedures entail immersing and rinsing the contaminated endoscopic biopsy forceps devices in a suitable chemical sterilizing solutions and/or subjecting the biopsy devices to sterilizing in an autoclave. The sterilizing of the biopsy devices with the utilization of chemical sterilizing solutions has, in more recent years, given rise to concerns that the contaminated biopsy devices were

1 not adequately sterilized for reuse with other
patients, particularly in view of the considerable
dangers to patients through exposure to poten-
tially serious and even life-threatening infection
5 with the AIDS virus (Acquired Immunity Deficiency
Syndrome) or hepatitis B viruses, wherein
sterilizing of the devices by means of such
chemical solutions may not always be adequate to
destroy the viruses, or at the very least, raise
10 doubts as to the efficacy of the solutions.
Furthermore, subjecting currently utilized
endoscopic biopsy forceps devices to sterilizing
procedures in an autoclave, under extremely
rigorous physical conditions, frequently causes
15 the rather delicate biopsy forceps devices to be
destroyed, or damaged, and warped to such an
extent as to render the devices unusable for
repeated applications.

In order to overcome the limitations and
20 drawbacks which are currently encountered in the
technology, and in particular endoscopy, with
respect to the constructions and employment of
endoscopic biopsy forceps which will meet with the
requirements of the medical profession, the
25 present invention contemplates the provision of an
endoscopic biopsy forceps device which, to an
appreciable and highly desirably extent, reduces
the large number of components in each such
device; and in particular, affords for a
30 considerable reduction in the necessary
articulated elements, pivot points, rivets and
attendant riveting operations in assembling the

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1 forceps device. In view of the complex
construction of such prior art biopsy forceps
devices are extremely expensive, and because it
may not always be possible to properly sterilize
5 the device to provide adequate safeguards against
infections for patients exposed to previously used
devices, rendering discarding thereof uneconomical,
and possibly subjecting the medical facility
and/or staff to legal liabilities in the event a
10 patient is infected by a contaminated device.

Among the typical types of endoscopic
biopsy forceps and similar types of devices which
are currently known, the following are considered
to be representative of the state-of-the
15 technology.

Komiya, U.S. Patent 4,038,987 discloses
a forceps device for an endoscope, wherein the
operation of the cutting jaws of the forceps are
effectuated through the intermediary of a toggle
20 joint which is articulated by a control wire
through the interposition of suitable linkage
components. The toggle mechanism provided for in
this patent necessitates the utilization of
separate pivot pins for each jaw and provides for
25 the type of operation in which the least amount of
mechanical advantage is applied to the jaws during
the closing of the forceps. This structure
utilizes a multiplicity of linkage elements and
pivots, rendering it highly susceptible to damage
30 during sterilizing, while the device is extremely
expensive because of the numerous components
employed therein, necessitating the repeated use

1 thereof in order to cause the device to be
economical.

Blake, III, U.S. Patent 4,662,374
discloses a ligator device in which a cam track is
5 employed as a so-called "time delay" for the
retraction of the clips proximate one of the
clamping jaws. The operation of the camming
arrangement utilized in Blake is completely unlike
that of the camming arrangement utilized in the
10 inventive endoscopic biopsy forceps and, moreover,
necessitates the incorporation of an additional
toggle mechanism in order to actuate the movement
of the jaws. This particular device would not be
employable as an endoscopic biopsy forceps.

15 Rich, U.S. Patent 4,752,185 employs a
movable pin engaging a cam track in an operative
mode as described hereinabove with respect to
Blake, and necessitates the incorporation of a
secondary pin as a pivot for the jaws of a
20 surgical needle holder. This structure requires a
more complex pin and cam track arrangement in
comparison with the inventive endoscopic biopsy
forceps device, and necessitates the utilization
of auxiliary components which render the structure
25 thereof expensive and inapplicable to a simple
biopsy forceps device as is contemplated by the
present invention.

Walter, et al., U.S. Patent 4,171,701
primarily pertains to a camping structure
30 incorporated into a tweezer device, which requires
the use of a secondary pin and linkage components
in order to actuate the jaws of the device, and is

1 not at all suggestive of the simple, reliable and
inexpensive camming arrangement employed in
conjunction with the inventive endoscopic biopsy
forceps device.

5 Further types of biopsy forceps and the
like, all of which employ relatively complex pivot
points, linkages and toggle mechanisms, are
respectively disclosed in Komiya, U.S. Patent
3,840,003; Hayashi, U.S. Patent 4,669,471;
10 Maslamka, U.S. Patent 4,646,751; and Schmidt, U.S.
Patent 3,895,636. The constructions disclosed
therein are primarily of the complex pivot pin and
linkage systems, also employing toggle linkages
and parallelogram linkages, which render the
15 devices extremely complex, expensive and not at
all adapted for single use or so-called throw-away
operation as contemplated by the invention.

Accordingly, in order to eliminate or
ameliorate the disadvantages and drawbacks
20 encountered in prior art biopsy forceps,
particularly those employed in endoscopy, the
present invention relates to a unique and novel
endoscopic biopsy forceps device inexpensively
constituted from only a few and simple parts,
25 wherein the usual types of linkages and number of
pivot points required for the articulation of the
forceps jaws have been extensively eliminated or
reduced, and replaced by a simple camming
arrangement in the form of cam tracks which,
30 nevertheless, results in a highly reliable and
simply operated endoscopic biopsy forceps device.
This novel structure extensively reduces the

1 production costs of the foregoing forceps device
to such an extent in comparison with the more
complex prior art devices, such as to enable the
device to be economically employed and discarded
5 after only a single use; in essence, causing the
device to become an inexpensive, disposable or so-
called "throw-away" endoscopic biopsy forceps.
This eliminates the necessity for having to
subject the endoscopic biopsy forceps device to
10 sterilizing in a chemical solution and/or an
autoclave, and completely eliminates the danger of
possible infection of a patient by a previously
used and sterilized, but possibly still
contaminated forceps device.

15 In order to achieve the foregoing
object, the inventive endoscopic biopsy forceps
device incorporates a novel camming arrangement
comprising cooperating cam tracks formed in each
of the shank portions of the cooperating forceps
20 levers which cam tracks are displaceable along the
surface a stationary guide or cam pin extending
therethrough, and which is fastened to a housing
attached to a flexible sheath which, in turn, is
connected to an operating handle for the
25 endoscope. The levers of the endoscopic biopsy
forceps are articulated to a member which is
slidable within a housing fastened to the end of
the flexible sheath, the slidable member being
reciprocated by a wire extending within the
30 sheath, causing the cam tracks to move along the
stationary pivot pin such as to in view of their
curvatures or shapes, respectively, open or close

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1 clamping jaws on the forceps levers. This
construction reduces the number of pivot points
encountered in prior art devices, and reduces the
linkage components and pivots required by more
5 than one-half in comparison with those of the
currently known endoscopic biopsy forceps devices.

Pursuant to a preferred embodiment of
the invention, the stationary pivot or pin along
which the cam tracks are movable may be in the
10 form of a screw extending through and fastened to
the housing, thereby eliminating the necessity for
welding and/or riveting of a pivot pin, and even
further increasing the reliability and reducing
the cost of the biopsy forceps device.

15 In accordance with a modification of the
invention, the cam tracks may be of a linearly-
angled slot configuration so as to impart the
greatest clamping force to the jaws upon closing
thereof.

20 The present invention relates to a
biopsy forceps which is insertable through an
endoscope into a body cavity for the separation of
tissue therefrom; said forceps device comprising a
flexible tubular sheath; a housing member secured
25 to one end of said sheath and having a slot
extending therethrough; a wire extending coaxially
within said sheath for telescoping movement
relative thereof; a movable member slidably
supported in the slot of said housing member and
30 being fastened to said wire; a pair of forceps
levers each having a shank portion and an
operating jaw extending from one end of said shank

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1 portion; means at the opposite end of each said
shank portion of each said lever for articulating
said forceps levers to said movable member, a cam
track consisting of a slot formed in the shank
5 portion intermediate the ends thereof; and pivot
means extending through said slot in each said
lever shank portion and being fixedly connected to
said housing member, whereby axial displacement of
said movable member relative to said housing
10 member responsive to axial movement of said wire
in said sheath causes said slots to move in
camming surface contact along said fixed pivot
means and to pivot said forceps levers into
respective opening and clamping movements of the
15 clamping jaws on said forceps levers.

Reference may now be had to the
following detailed description of exemplary
embodiments of the invention showing preferred
constructions for the inventive endoscopic biopsy
20 forceps device; taken in conjunction with the
accompanying drawings, in which:

Figure 1 illustrates, generally
diagrammatically, a first embodiment of the
operating end of an endoscopic biopsy forceps
25 device which is constructed pursuant to the
invention, the forceps jaws thereof being shown in
an opened condition;

Figure 2 illustrates the device of Fig.
1 with the clamping jaws of the forceps shown in a
30 closed position;

Figure 3 illustrates a sectional view
through the device taken along line 3-3 in Fig. 2;

1 and,

Figure 4 illustrates a second embodiment
of the endoscopic biopsy forceps device similar to
Fig. 1 but with a modified cam track configura-
5 tion.

Referring now in detail to Figs. 1 to 3,
there is illustrated the inventive endoscopic
biopsy forceps device 10 which includes a forceps
sheath 12 constituted of a generally flexible or
10 pliable material; for instance, teflon tubing or
the like, which is connected a distal end thereof
to a suitable operating mechanism (not shown) for
actuating the forceps jaw structure of the biopsy
forceps device.

15 Attached to the illustrated end of the
sheath 23 is a suitable forceps lever support
housing 14, which, if desired, may be constituted
of stainless steel, and which includes a
longitudinal central slot 16 fully extending
20 between two opposite halves 18 and 19 of the
housing 14. A slide member 20 is slidably
supported for reciprocatory movement in the slot
16 in coaxial relationship with the flexible
sheath 12. The slide member 20 has one end
25 thereof fastened to a flexible cable or wire 22
which is telescopingly movable within the sheath
12 in response to operation of the endoscope
operating mechanism (not shown), as is well known
in this technology.

30 A pair of cooperating forceps levers 24
and 26 are articulated to the slide member 20
through the intermediary of pivots 28 and 30, as

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1 shown in more extensive detail in Figs. 2 and 3.
The pivots may be integrally formed with or
fastened to the slide member 20, whereby
reciprocatory movement of the wire 22 within the
5 sheath 12 in response to actuation thereof will
cause the pivots 28 and 30 to be rotated within
bores 29, 31 in the shank portions of the forceps
levers while being axially displaced within the
slot 16 of housing 14 along with directions of
10 double-headed arrow A, depending upon whether the
forceps devices is to be opened or closed. The
articulation of the wire 22, which causes the
displacement of pivots 28 and 30 along the
directions of arrow A will cause the concurrent
15 displacement of the shank ends of the forceps
levers 24 and 26 which are hinged to the sides
member 20 at these pivots. The pivots 28, 30, if
desired, may also be formed or rivets for
fastening the forceps levers to the slide member.
20 The camming action which is imparted to
the forceps levers 24 and 26 in response to the
actuation or movement of wire 22 within the sheath
12 so as to selectively open or close forceps
clamping jaws 34 and at the free ends of the
25 forceps levers distant from pivots 28, 30, is
effectuated through the intermediary of novel
camming arrangement provided for on the forceps
levers 28, 30 incorporation with housing 14. This
arrangement comprises cam tracks, in the form of
30 an elongate arcuate slot 38 formed in lever 24 and
a similar oppositely curved slot 40 in other
forceps lever 26, adapted to superimposed impart,

1 as shown in detail in Fig. 1 of the drawings. A
fixed or stationary pivot pin 42, extends
transversely through the cam track slots 38, 40,
and is preferably in the shape of a screw which
5 has the leading end of the screw portion thereof
threadingly arranged in a completely threaded hole
44 formed in one of the opposite halves 18 or 19
of the housing 14, and with the head end of the
screw being recessed in the opposite housing half
10 so as to have the screw (or pivot pin) extend
across the slot 16.

Fastened to the slide 20 so as to extend
axially from the slot 16 between the clamping jaws
34 and 36 on the forceps levers, is a suitable
15 pointed spike element 46, for engaging tissue from
a body cavity of a patient, which tissue is to be
clamped off by the jaws of the forceps for
purposes of biopsies, as is well-known in the art.

As may be ascertained from the
20 foregoing, the axial displacement of the slide
member 20 with the pivots 28, 30, and the
resultant movement of the ends of forceps levers
24, 26 which are hinged thereto, causes the cam
track slots 38, 40 to move relative to the fixed
25 pin or screw 42 extending therethrough.
Consequently, as the wire 22 is retracted in the
sheath 12, pulling the sliding member 20 and
pivots 28, 30 away from the fixed screw or pin 42,
the slots 38, 40 are biased together by the
30 presence of the screw in their ends towards the
forceps jaws, as shown in Fig. 2, and the forceps
jaws pivoted towards each other into clamping

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1 engagement. Conversely, the movement of slide
member 20 in the opposite direction of arrow A,
causes the slots 38, 40 to be moved along screw 42
into a position towards the lower ends of slots
5 38, 40 (as shown in Fig. 1), and pivots the
forceps levers 24, 26 apart so as to open the
forceps jaws 34, 36. In essence, all movement is
effected relative to a single fixed and two
displaceable pivot joints in the camming
10 arrangement, rather than through the numerous
pivots of the prior art devices.

The embodiment illustrated in Fig. 4 of
the drawings in which all components similar to or
identical with those in Figs. 1 through 3 are
15 designated with the same reference numerals, is
merely modified with regard to the previous
embodiment, in that the cam track slots 50 and 52
each have two continuous linear portions 50' and
50'', and 52' and 52'' angled with regard to each
20 other in lieu of the curvilinear cam track
configurations of the previous embodiment. The
portions 50' and 52' of the cam track slots 50, 52
which are proximate the ends of the forceps jaws
are angled so as to extend more acutely with or
25 closer to the axial centerline of the slide member
20 and forceps levers 24, 26 such that, upon
closing of the forceps jaws, any further
displacement of the wire 22 tending to continue
closing of the jaws will impart a greater biasing
30 or clamping force to the cooperating jaws by the
screw in the slots, thereby enhancing the clamping

1 action or mechanical advantage in gripping any
tissue between the jaws.

From the foregoing, it becomes readily
apparent to one skilled in the art that the novel
5 endoscopic biopsy forceps device is constituted of
appreciably fewer and simpler parts than the
devices which are currently being marketed,
offering an enhanced degree of product reliability
through the reduction of components, simplicity in
10 design, operation and manufacture, which renders
the entire device much less expensive and highly
economical in comparison with currently employed
devices, so as to adapt it for use as a "throw-
away" unit.

15 Due to the inventive camming arrange-
ment, wherein the opening and closing movement of
the forceps levers and of the forceps jaws are
improved, the advantages offered by the inventive
structure resides in:

20 (a) the cutting plane of the forceps
jaws being closer to that of a straight line in
comparison with the curvilinear movement employed
by prior art devices, which results in an improved
cutting action during the separation of the
25 desired specimen or tissue;

(b) during the closing of the forceps
jaws, the specimen or tissue is prevented from
slipping out of the cutting zone of the biopsy
forceps;

30 (c) the production cost of the
inventive endoscopic biopsy forceps device is
considerably reduced due to the considerably fewer

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1 employed components and articulated parts, thereby
also increasing its operational reliability and
stability;

(d) the area provided for engaging the
5 jaws in cutting the specimen or tissue is
considerably larger than for conventional forceps;

(e) basically all rivets and linkages
encountered in prior art forceps of this type have
been eliminated, which simplifies the overall
10 assembly and also reduces the necessary assembling
time for the forceps device;

(f) the resultant shorter operating
stroke provided for by the camming arrangement
increases the radius of operation of the device
15 and imparts better control and feel of the device
to nurses, physicians or medical technicians
handling the forceps;

(g) elimination of any danger to a
patient caused by an infection through the
20 subsequent use of a biopsy forceps device which
may still be contaminated, in that the reduction
in the cost thereof renders the device disposable
as a "throw-away" after a single use, while
nevertheless still being appreciably more
25 cost-effective in contrast with currently utilized
biopsy forceps devices.

While there has been shown and described
what is considered to be preferred embodiments of
the invention, it will, of course, be understood
30 that various modifications and changes in form or
detail could readily be made without departing
from the spirit of the invention. It is therefore

¹intended that the invention not be limited to the exact form than the whole of the invention herein disclosed as hereinafter claimed.

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SUBSTITUTE SHEET

1 WHAT IS CLAIMED IS:

1. A biopsy forceps device which is insertable through an endoscope into a body cavity for the separation of tissue therefrom; said
5 forceps device comprising a flexible tubular sheath; a housing member secured to one end of said sheath and having a slot extending there-
through; a wire extending coaxially within said sheath for telescoping movement relative thereof;
10 a movable member slidably supported in the slot of said housing member and being fastened to said wire; a pair of forceps levers each having a shank portion and an operating jaw extending from one
end of said shank portion; means at the opposite
15 end of each said shank portion of each said lever for articulating said forceps levers to said movable member, a cam track consisting of a slot formed in the shank portion intermediate the ends
thereof; and pivot means extending through said
20 slot in each said slot in each said lever shank portion and being fixedly connected to said housing member, whereby axial displacement of said movable member relative to said housing member
responsive to axial movement of said wire in said
25 sheath causes said slots to move in camming surface contact along said fixed pivot means and to pivot said forceps levers into respective opening and clamping movements of the clamping
jaws on said forceps levers.

30 2. A forceps device as claimed in Claim 1, wherein said pivot means extending through said cam slots in said forceps levers comprises a screw

1 member extending across the slot in said housing
member and includes a threaded screw portion
engaged in a threaded bore in said housing member.

3. A forceps device as claimed in Claim
5 1, wherein said forceps levers are articulated to
said link member by pivots on said movable member
pivotally engaging into bores in the shank
portions of said levers.

4. A forceps device as claimed in Claim
10 3, wherein said pivots are integrally formed with
said movable member.

5. A forceps device as claimed in Claim
1, wherein said cam slots comprise elongate
arcuate slots extending in oppositely curved
15 orientations in each of said forceps levers.

6. A forceps device as claimed in Claim
1, wherein said cam slots comprise elongate slots
having first and second linear elongate slot
portions angled relative to each other and
20 extending in oppositely sloped orientations in each
of said forceps levers for effectuating the
respective opening and closing camming movements
of said forceps jaws.

7. A forceps device as claimed in Claim
25 6, wherein the portion of each of said linear
slots proximate the jaws extends at a narrow angle
relative to the longitudinal axis of the forceps
levers so as to increase the clamping action
between said forceps jaws subsequent to the
30 closing of said forceps.

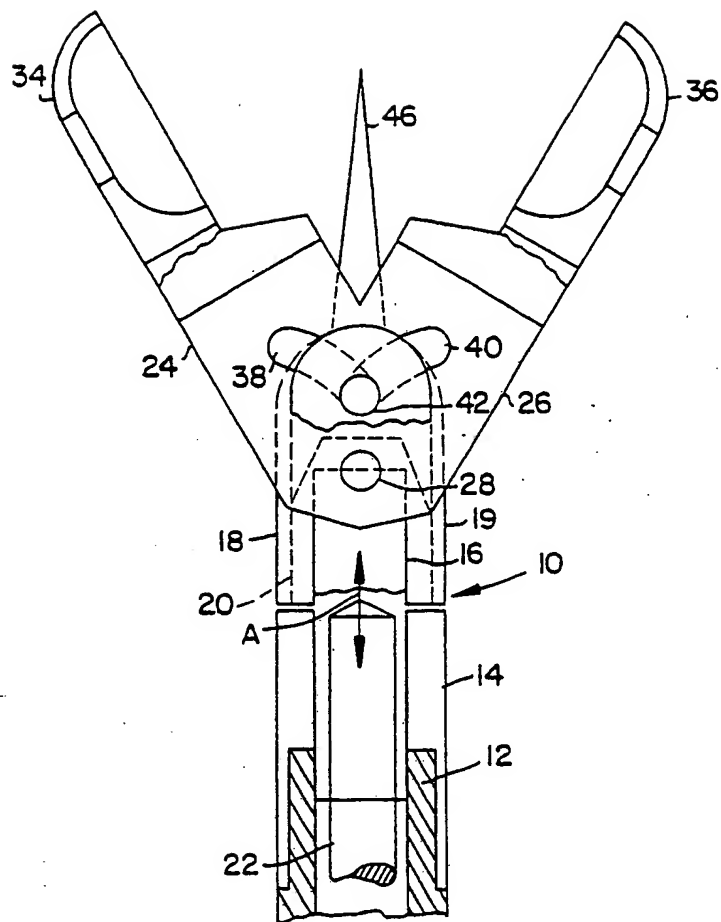


FIG. 1

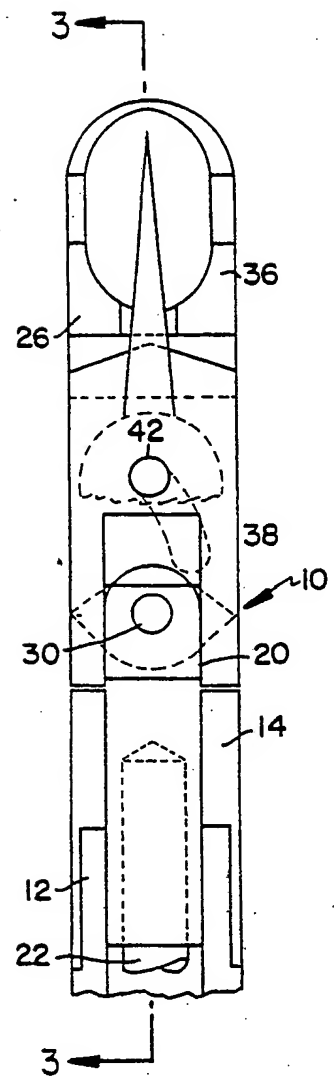


FIG. 2

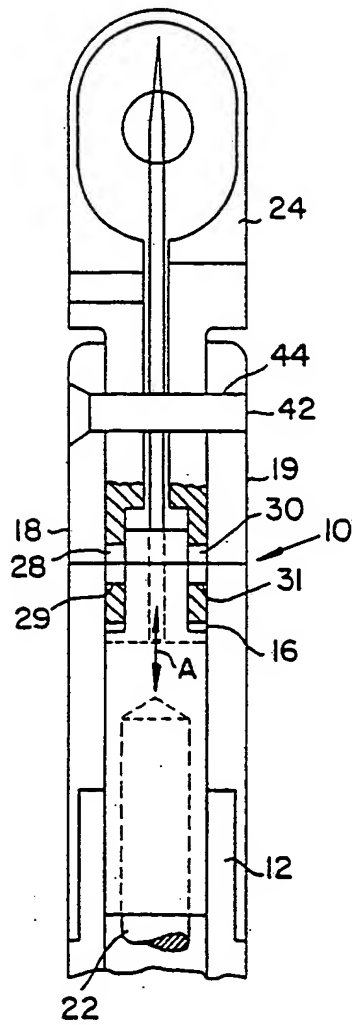


FIG. 3

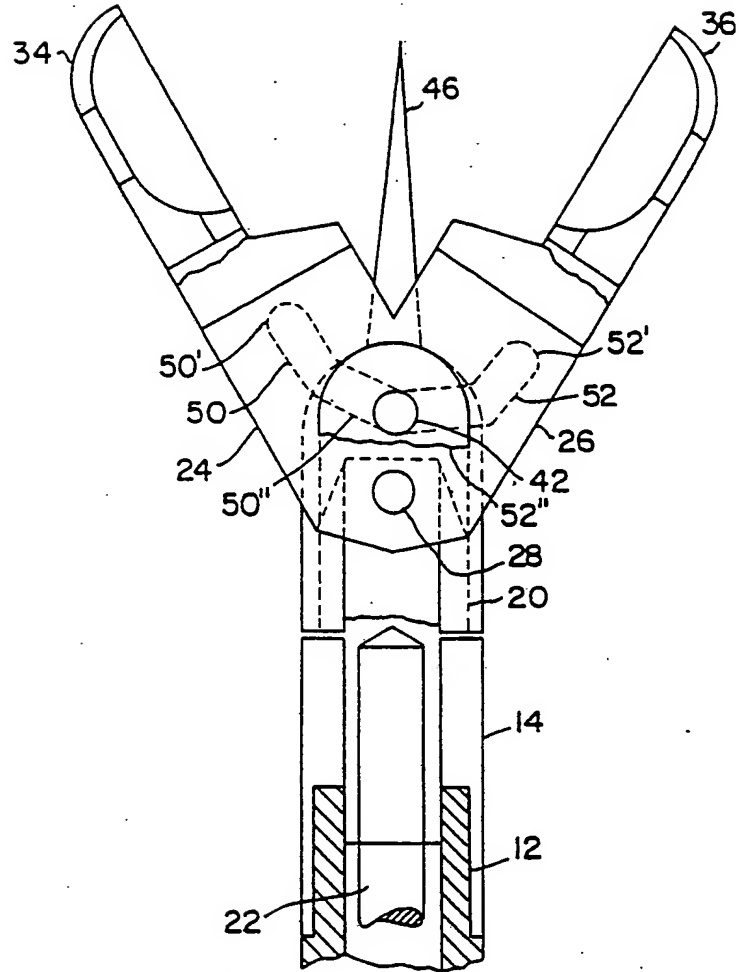
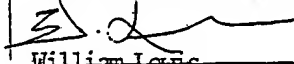


FIG. 4

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC(4) A61B 10/00		
US Cl. 128/751		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
US	128/4-10,303R,303.1,321,345,749,751 604/22 294/115,116 81/128	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category [*]	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
Y	US,A, 3,895,636 (SCHMIDT) 22 July 1975 See entire document.	1-7
A	US,A, 4,151,763 (COLVIN) 01 May 1979 See figure 2; lines 60-69, column 4.	1-7
A	US,A, 4,662,374 (BLAKE, III) 05 May 1987 See figure 4; lines 28-49, column 2.	1-7
<p>[*] Special categories of cited documents: ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search		Date of Mailing of this International Search Report
09 June 1989		17 JUL 1989
International Searching Authority		Signature of Authorized Officer
ISA/US		 William Lewis

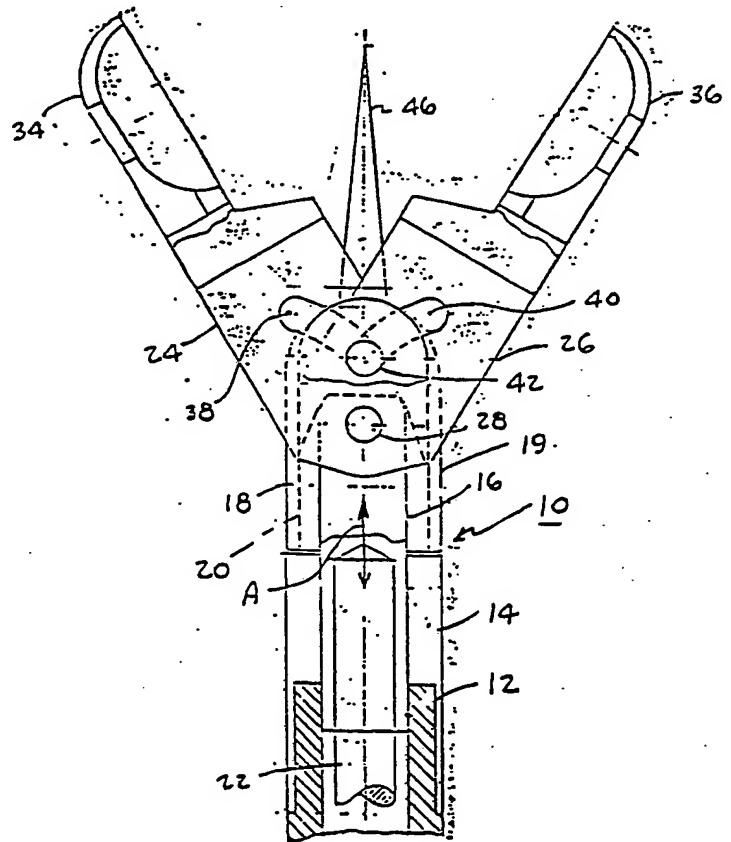
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<p>(21) International Application Number: PCT/US89/01776</p> <p>(22) International Filing Date: 27 April 1989 (27.04.89)</p> <p>(30) Priority data: 186,564 27 April 1988 (27.04.88) US</p> <p>(71) Applicant: ESCO PRECISION, INC. [US/US]; 21 William Penn Drive, Stony Brook, NY 11790 (US).</p> <p>(72) Inventors: ESSER, Theodor ; 21 William Penn Drive, Stony Brook, NY 11790 (US). DOHERTY, Thomas, Edward ; 7 Carriage Lane, Setauket, NY 11733 (US).</p> <p>(74) Agent: SCOTT, Anthony, C.; Scully, Scott, Murphy & Presser, 400 Garden City Plaza, Garden City, NY 11530 (US).</p>		<p>(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent).</p> <p>Published With international search report.</p>

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An endoscopic biopsy forceps (10) device incorporating a novel and unique camming arrangement for selectively opening and closing the biopsy cutting jaws (34, 36) of the biopsy forceps (10) which will render the entire device of a simpler construction and reliable in operation, while concurrently making it considerably less expensive to produce.



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5 The present invention relates to biopsy forceps
and, more particularly, relates to an endoscopic biopsy
forceps device incorporating a novel and unique camming
arrangement for selectively opening and closing the biopsy
cutting jaws of the biopsy forceps which will render the
entire device of a simpler construction and reliable in
operation, while concurrently making it considerably less
10 expensive to produce.

15 Although varied types of biopsy forceps are
currently in widespread use, such as in conjunction with
endoscopic purposes, these are generally of complicated
constructions necessitating the manufacture and assembly of
numerous, highly precise components and, as a consequence,
are quite expensive. Ordinarily, an endoscopic biopsy
forceps device must be sterilized in strict compliance with
rigid medical standards after each use thereof with a
20 patient, so as to enable the device to again be safely
employed with another patient for subsequent medical and/or
surgical endoscopic biopsy procedures. Such sterilizing
procedures entail immersing and rinsing the contaminated
endoscopic biopsy forceps devices in a suitable chemical
sterilizing solutions and/or subjecting the biopsy devices
25 to sterilizing in an autoclave. The sterilizing of the
biopsy devices with the utilization of chemical sterilizing
solutions has, in more recent years, given rise to concerns
that the contaminated biopsy devices were not adequately
sterilized for reuse with other patients, particularly in
30 view of the considerable dangers to patients through
exposure to potentially serious and even life-threatening

1 infection with the AIDS virus (Acquired Immunity Deficiency
Syndrome) or hepatitis B viruses, wherein sterilizing of the
devices by means of such chemical solutions may not always
be adequate to destroy the viruses, or at the very least,
5 raise doubts as to the efficacy of the solutions.
Furthermore, subjecting currently utilized endoscopic biopsy
forceps devices to sterilizing procedures in an autoclave,
under extremely rigorous physical conditions, frequently
causes the rather delicate biopsy forceps devices to be
10 destroyed, or damaged and warped to such an extent as to
render the devices unusable for repeated applications.

In order to overcome the limitations and drawbacks
which are currently encountered in the technology, and
particular in endoscopy, with respect to the constructions
and employment of endoscopic biopsy forceps which will meet
15 with the requirements of the medical profession, the present
invention contemplates the provision of an endoscopic biopsy
forceps device which, to an appreciable and highly desirably
extent, reduces the large number of components in each such
device; and in particular, affords for a considerable
20 reduction in the necessary articulated elements, pivot
points, rivets and attendant riveting operations in
assembling the forceps device. In view of the complex
construction of such prior art biopsy forceps devices are
extremely expensive, and because it may not always be
25 possible to properly sterilize the device to provide
adequate safeguards against infections for patients exposed
to previously used devices, rendering discarding thereof
uneconomical, and possibly subjecting the medical facility
and/or staff to legal liabilities in the event a patient is
30 infected by a contaminated device.

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Among the typical types of endoscopic biopsy forceps and similar types of devices which are currently known, the following are considered to be representative of the state-of-the-technology.

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Komiya U. S. Patent 4,038,987 discloses a forceps device for an endoscope, wherein the operation of the cutting jaws of the forceps are effectuated through the intermediary of a toggle joint which is articulated by a control wire through the interposition of suitable linkage components. The toggle mechanism provided for in this patent necessitates the utilization of separate pivot pins for each forceps jaw and provides for the type of operation in which the least amount of mechanical advantage is applied to the jaws during the closing of the forceps. This structure utilizes a multiplicity of linkage elements and pivots, rendering it highly susceptible to damage during sterilizing, while the device is extremely expensive because of the numerous components employed therein, necessitating the repeated use thereof in order to cause the device to be economical.

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Blake, III, U. S. Patent 4,662,374 discloses a ligator device in which a cam track is employed as a so-called "time delay" for the retraction of the clips proximate one of the clamping jaws. The operation of the camming arrangement utilized in Blake is completely unlike that of the camming arrangement utilized in the inventive endoscopic biopsy forceps and, moreover, necessitates the incorporation of an additional toggle mechanism in order to actuate the movement of the jaws. This particular device would not be employable as an endoscopic biopsy forceps.

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1 Rich U. S. Patent 4,572,185 employs a movable pin
engaging a cam track in an operative mode as described
hereinabove with respect to Blake, and necessitates the
incorporation of a secondary pin as a pivot for the jaws of
5 a surgical needle holder. This structure requires a more
complex pin and cam track arrangement in comparison with the
inventive endoscopic biopsy forceps device, and necessitates
the utilization of auxiliary components which render the
structure thereof expensive and inapplicable to a simple
10 biopsy forceps device as is contemplated by the present
invention.

Walter, et al. U. S. Patent 4,171,701 primarily
pertains to a camming structure incorporated into a tweezer
device, which requires the use of secondary pin and linkage
15 components in order to actuate the jaws of the device, and
is not at all suggestive of the simple, reliable and
inexpensive camming arrangement employed in conjunction with
the inventive endoscopic biopsy forceps device.

Further types of biopsy forceps and the like, all
20 of which employ relatively complex pivot points, linkages
and toggle mechanisms, are respectively disclosed in Komiya
U. S. Patent 3,840,003; Hayashi U. S. Patent 4,669,471;
Maslamka U. S. Patent 4,646,751; and Schmidt U. S. Patent
3,895,636. The constructions disclosed therein are
25 primarily of the complex pivot pin and linkage systems, also
employing toggle linkages and parallelogram linkages,
which render the devices extremely complex, expensive and
not at all adapted for single use or so-called throw-away
operation as contemplated by the invention.

30 Accordingly, in order to eliminate or ameliorate
the disadvantages and drawbacks encountered in prior art

1 biopsy forceps, particularly those employed in endoscopy, the
present invention relates to a unique and novel endoscopic
biopsy forceps device inexpensively constituted from only a
few and simple parts, wherein the usual types of linkages
5 and number of pivot points required for the articulation of
the forceps jaws have been extensively eliminated or
reduced, and replaced by a simple camming arrangement in the
form of cam tracks which, nevertheless, results in a highly
reliable and simply operated endoscopic biopsy forceps
10 device. This novel structure extensively reduces the
production costs of the forceps device to such an extent in
comparison with the more complex prior art devices, such as
to enable the device to be economically employed and
discarded after only a single use; in essence, causing the
15 device to become an inexpensive, disposable or so-called
"throw-away" endoscopic biopsy forceps. This eliminates the
necessity for having to subject the endoscopic biopsy
forceps device to sterilizing in a chemical solution and/or
an autoclave, and completely eliminates the danger of
20 possible infection of a patient by a previously used and
sterilized, but possibly still contaminated forceps device.

In order to achieve the foregoing object, the
inventive endoscopic biopsy forceps device incorporates a
novel camming arrangement comprising cooperating cam tracks
25 formed in each of the shank portions of the cooperating
forceps levers which cam tracks are displaceable along the
surface a stationary guide or cam pin extending
therethrough, and which is fastened to a housing attached to
a flexible sheath which, in turn, is connected to an
operating handle for the endoscope. The levers of the
30 endoscopic biopsy forceps are articulated to a member which
is slidable within a housing fastened to the end of the

1 flexible sheath, the slidable member being reciprocated by a
wire extending within the sheath, causing the cam tracks to
move along the stationary pivot pin such as to in view of
their curvatures or shapes, respectively, open or close
5 clamping jaws on the forceps levers. This construction
reduces the number of pivot points encountered in prior art
devices, and reduces the linkage components and pivots
required by more than one-half in comparison with those of
the currently known endoscopic biopsy forceps devices.

10 Pursuant to a preferred embodiment of the
invention, the stationary pivot or pin along which the cam
tracks are movable may be in the form of a screw extending
through and fastened to the housing, thereby eliminating the
necessity for welding and/or riveting of a pivot pin, and
15 even further increasing the reliability and reducing the
cost of the biopsy forceps device.

In accordance with a modification of the
invention, the cam tracks may be of a linearly-angled slot
configuration so as to impart the greatest clamping force to
the jaws upon closing thereof.

20 The present invention relates to a biopsy forceps
which is insertable through an endoscope into a body cavity for
the separation of tissue therefrom; said forceps device comprising
a flexible tubular sheath; a housing member secured to one end
25 of said sheath and having a slot extending therethrough; a
wire extending coaxially within said sheath for telescoping
movement relative thereof; a movable member slidably
supported in the slot of said housing member and being
fastened to said wire; a pair of forceps levers each having
30 a shank portion and an operating jaw extending from one end
of said shank portion; means at the opposite end of each
said shank portion of each said lever for articulating said
forceps levers to said movable member, a cam track
consisting of a slot formed in the shank portion
35 intermediate the ends thereof; and pivot means extending

1 through said slot in each said lever shank portion and being
fixedly connected to said housing member, whereby axial
displacement of said movable member relative to said housing
5 member responsive to axial movement of said wire in said
sheath causes said slots to move in camming surface contact
along said fixed pivot means and to pivot said forceps levers
into respective opening and clamping movements of the
clamping jaws on said forceps levers.

Reference may now be had to the following detailed
10 description of exemplary embodiments of the invention
showing preferred constructions for the inventive endoscopic
biopsy forceps device; taken in conjunction with the
accompanying drawings; in which:

Figure 1 illustrates, generally diagrammatically,
15 a first embodiment of the operating end of an endoscopic
biopsy forceps device which is constructed pursuant to the
invention, the forceps jaws thereof being shown in an opened
condition;

Figure 2 illustrates the device of Fig. 1 with the
20 clamping jaws of the forceps shown in a closed position;

Figure 3 illustrates a sectional view through the
device taken along line 3 - 3 in Fig. 2; and

Figure 4 illustrates a second embodiment of the
endoscopic biopsy forceps device similar to Fig. 1 but with a
25 modified cam track configuration.

Referring now in detail to Figs. 1 to 3, there is
illustrated the inventive endoscopic biopsy forceps device
10 which includes a forceps sheath 12 constituted of a
generally flexible or pliable material; for instance, teflon
30 tubing or the like, which is connected at a distal end
thereof to a suitable operating mechanism (not shown) for
actuating the forceps jaw structure of the biopsy forceps
device.

Attached to the illustrated end of the sheath 12
35 is a suitable forceps lever support housing 14, which, if

desired, may be constituted of stainless steel, and which includes a longitudinal central slot 16 fully extending between two opposite halves 18 and 19 of the housing 14. A slide member 20 is slidably supported for reciprocatory movement in the slot 16 in coaxial relationship with the flexible sheath 12. The slide member 20 has one end thereof fastened to a flexible cable or wire 22 which is telescopingly movable within the sheath 12 in response to operation of the endoscope operating mechanism (not shown), as is well known in this technology.

A pair of cooperating forceps levers 24 and 26 are articulated to the slide member 20 through the intermediary of pivots 28 and 30, as shown in more extensive detail in Figs. 2 and 3. The pivots may be integrally formed with or fastened to the slide member 20, whereby reciprocatory movement of the wire 22 within the sheath 12 in response to actuation thereof will cause the pivots 28 and 30 to be rotated within bores 29, 31 in the shank portions of the forceps levers while being axially displaced within the slot 16 of housing 14 along the directions of double-headed arrow A, depending upon whether the forceps devices is to be opened or closed. The articulation of the wire 22, which causes the displacement of pivots 28 and 30 along the directions of arrow A will cause the concurrent displacement of the shank ends of the forceps levers 24 and 26 which are hinged to the slide member 20 at these pivots. The pivots 28, 30, if desired, may also be formed or rivets for fastening the forceps levers to the slide member.

The camming action which is imparted to the forceps levers 24 and 26 in response to the actuation or movement of wire 22 within the sheath 12 so as to selectively open or close forceps clamping jaws 34 and 36 at the free

1 ends of the forceps levers distant from pivots 28, 30, is
effectuated through the intermediary of a novel camming
arrangement provided for on the forceps levers 28, 30
incorporation with housing 14. This arrangement comprises
5 cam tracks, in the form of an elongate arcuate slot 38
formed in lever 24 and a similar oppositely curved slot 40 in
the other forceps lever 26, adapted to superimposed impart,
as shown in detail in Fig. 1 of the drawings. A fixed or
stationary pivot pin 42, extends transversely through the cam
10 track slots 38, 40, and is preferably in the shape of a
screw which has the leading end of the screw portion thereof
threadingly arranged in a completely threaded hole 44 formed
in one of the opposite halves 18 or 19 of the housing 14,
and with the head end of the screw being recessed in the
15 opposite housing half so as to have the screw (or pivot pin)
extend across the slot 16.

Fastened to the slide 20 so as to extend axially
from the slot 16 between the clamping jaws 34 and 36 on the
forceps levers, is a suitable pointed spike element 46,
20 for engaging tissue from a body cavity of a patient, which
tissue is to be clamped off by the jaws of the forceps for
purposes of biopsies, as is well-known in the art.

As may be ascertained from the foregoing, the
axial displacement of the slide member 20 with the pivots
28, 30, and the resultant movement of the ends of forceps
25 levers 24, 26 which are hinged thereto, causes the cam track
slots 38, 40 to move relative to the fixed pin or screw 42
extending therethrough. Consequently, as the wire 22 is
retracted in the sheath 12, pulling the sliding member 20
and pivots 28, 30 away from the fixed screw or pin 42, the
30 slots 38, 40 are biased together by the presence of the
screw in their ends towards the forceps jaws, as shown in

1 Fig. 2, and the forceps jaws pivoted towards each other into
clamping engagement. Conversely, the movement of slide
member 20 in the opposite direction of arrow A, causes the
slots 38, 40 to be moved along screw 42 into a position
5 towards the lower ends of slots 38, 40 (as shown in Fig. 1),
and pivots the forceps levers 24, 26 apart so as to open the
forceps jaws 34, 36. In essence, all movement is effected
relative to a single fixed and two displaceable pivot joints
in the camming arrangement, rather than through the numerous
10 pivots of the prior art devices.

The embodiment illustrated in Fig. 4 of the
drawings in which all components similar to or identical
with those in Figs. 1 through 3 are designated with the same
reference numerals, is merely modified with regard to the
15 previous embodiment, in that the cam track slots 50 and 52
each have two continuous linear portions 50' and 50'', and
52' and 52'' angled with regard to each other in lieu of the
curvilinear cam track configurations of the previous
embodiment. The portions 50' and 52' of the cam track slots
20 50, 52 which are proximate the ends of the forceps jaws are
angled so as to extend more acutely with or closer to the
axial centerline of the slide member 20 and forceps levers
24, 26 such that, upon closing of the forceps jaws, any
further displacement of the wire 22 tending to continue
25 closing of the jaws will impart a greater biasing or
clamping force to the cooperating jaws by the screw in the
slots, thereby enhancing the clamping action or mechanical
advantage in gripping any tissue between the jaws.

From the foregoing, it becomes readily apparent to
one skilled in the art that the novel endoscopic biopsy
30 forceps device is constituted of appreciably fewer and
simpler parts than the devices which are currently being

1 marketed, offering an enhanced degree of product reliability
through the reduction of components, simplicity in design,
operation and manufacture, which renders the entire device
much less expensive and highly economical in comparison with
5 currently employed devices, so as to adapt it for use as a
"throw-away" unit.

Due to the inventive camming arrangement, wherein
the opening and closing movement of the forceps levers and of
the forceps jaws are improved, the advantages offered by the
inventive structure resides in:

10 (a) the cutting plane of the forceps jaws being
closer to that of a straight line in comparison with the
curvilinear movement employed by prior art devices, which
results in an improved cutting action during the separation
of the desired specimen or tissue;

15 (b) during the closing of the forceps jaws, the
specimen or tissue is prevented from slipping out of the
cutting zone of the biopsy forceps;

(c) the production cost of the inventive
20 endoscopic biopsy forceps device is considerably reduced due
to the considerably fewer employed components and
articulated parts, thereby also increasing its operational
reliability and stability;

(d) the area provided for engaging the jaws in
25 cutting the specimen or tissue is considerably larger than
for conventional forceps;

(e) basically all rivets and linkages encountered
in prior art forceps of this type have been eliminated,
which simplifies the overall assembly and also reduces the
necessary assembling time for the forceps device.

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1 (f) the resultant shorter operating stroke
provided for by the camming arrangement increases the radius
of operation of the device and imparts better control and
feel of the device to nurses, physicians or medical
5 technicians handling the forceps;

(g) elimination of any danger to a patient caused
by an infection through the subsequent use of a biopsy
forceps device which may still be contaminated, in that the
reduction in the cost thereof renders the device disposable
10 as a "throw-away" after a single use, while nevertheless
still being appreciably more cost-effective in contrast with
currently utilized biopsy forceps devices.

While there has been shown and described what is
considered to be preferred embodiments of the invention, is
will, of course, be understood that various modifications and
15 changes in form or detail could readily be made without
departing from the spirit of the invention. It is therefore
intended that the invention be not limited to the exact form
than the whole of the invention herein disclosed as
hereinafter claimed.
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WHAT IS CLAIMED IS:

1. A biopsy forceps device which is insertable through an endoscope into a body cavity for the separation of tissue therefrom; said forceps device comprising a flexible tubular sheath; a housing member secured to one end of said sheath and having a slot extending therethrough; a wire extending coaxially within said sheath for telescoping movement relative thereof; a movable member slidably supported in the slot of said housing member and being fastened to said wire; a pair of forceps levers each having a shank portion and an operating jaw extending from one end of said shank portion; means at the opposite end of each said shank portion of each said lever for articulating said forceps levers to said movable member, a cam track consisting of a slot formed in the shank portion intermediate the ends thereof; and pivot means extending through said slot in each said lever shank portion and being fixedly connected to said housing member, whereby axial displacement of said movable member relative to said housing member responsive to axial movement of said wire in said sheath causes said slots to move in camming surface contact along said fixed pivot means and to pivot said forceps levers into respective opening and clamping movements of the clamping jaws on said forceps levers.

2. A forceps device as claimed in Claim 1, wherein said pivot means extending through said cam slots in said forceps levers comprises a screw member extending across the slot in said housing member and includes a threaded screw portion engaged in a threaded bore in said housing member.

1 3. A forceps device as claimed in Claim 1,
wherein said forceps levers are articulated to said link
member by pivots on said movable member pivotally engaging
into bores in the shank portions of said levers.

5 4. A forceps device as claimed in Claim 3, wherein
said pivots are integrally formed with said movable member .

 5. A forceps device as claimed in Claim 1, wherein
said cam slots comprise elongate arcuate slots extending in
oppositely curved orientations in each of said forceps
levers.

10 6. A forceps device as claimed in Claim 1,
wherein said cam slots comprise elongate slots having first
and second linear elongate slot portions angled relative to
each other and extending in oppositely sloped orientations
15 in each of said forceps levers for effectuating the
respective opening and closing camming movements of said
forceps jaws.

 7. A forceps device as claimed in Claim 6,
wherein the portion of each of said linear slots proximate
the jaws extends at a narrow angle relative to the
20 longitudinal axis of the forceps levers so as to increase
the clamping action between said forceps jaws subsequent to
this closing of said forceps.

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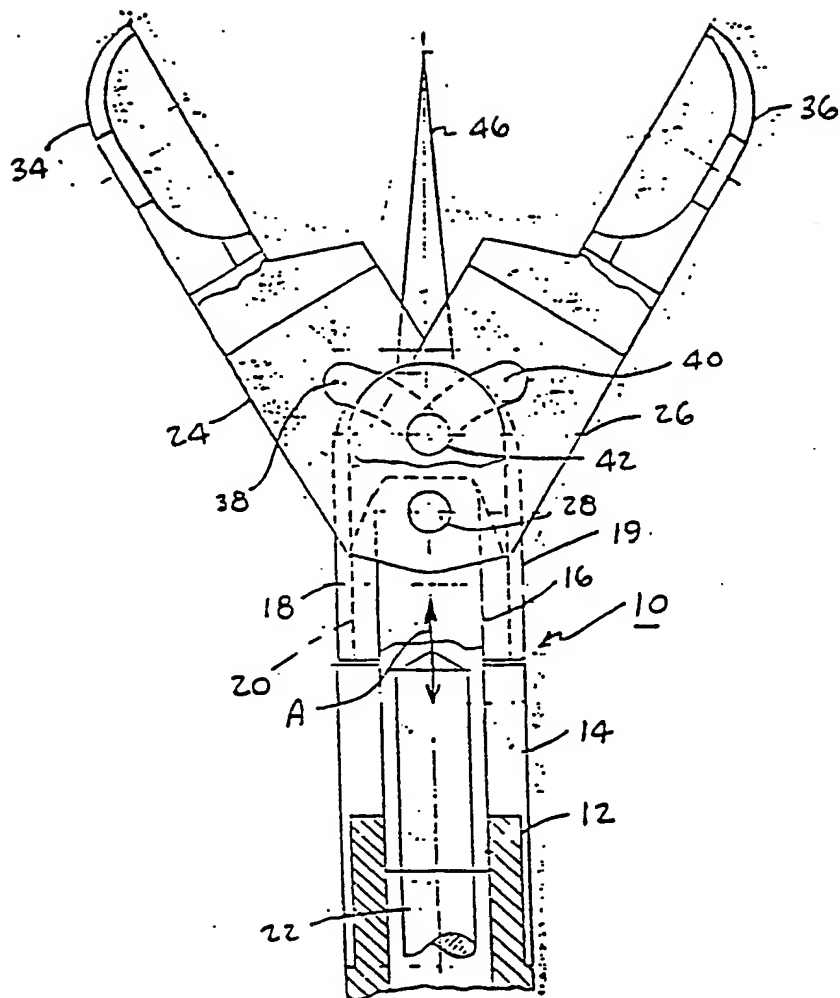


FIG. 1

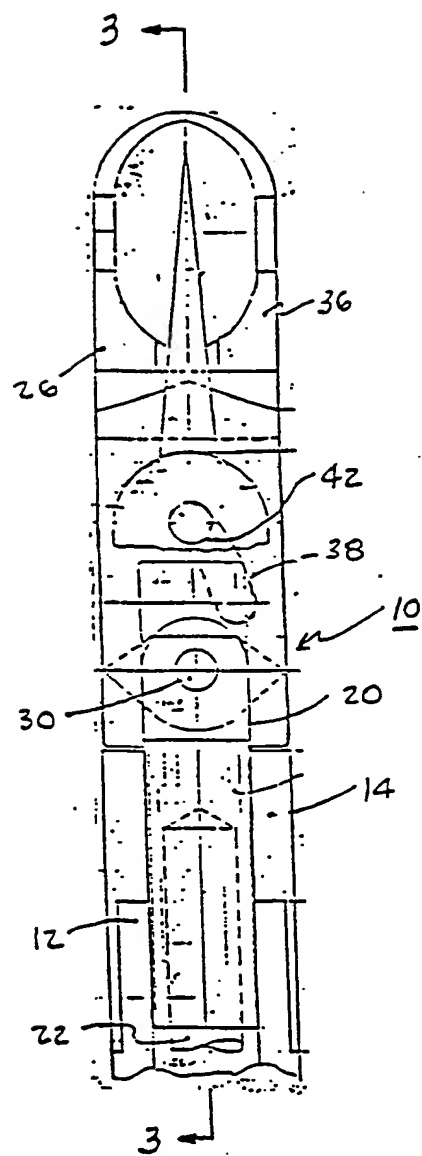


FIG. 2

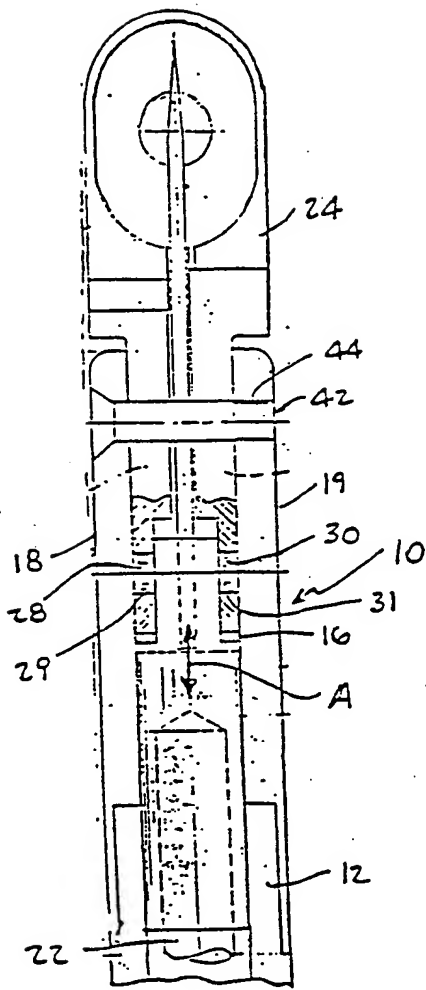


FIG. 3

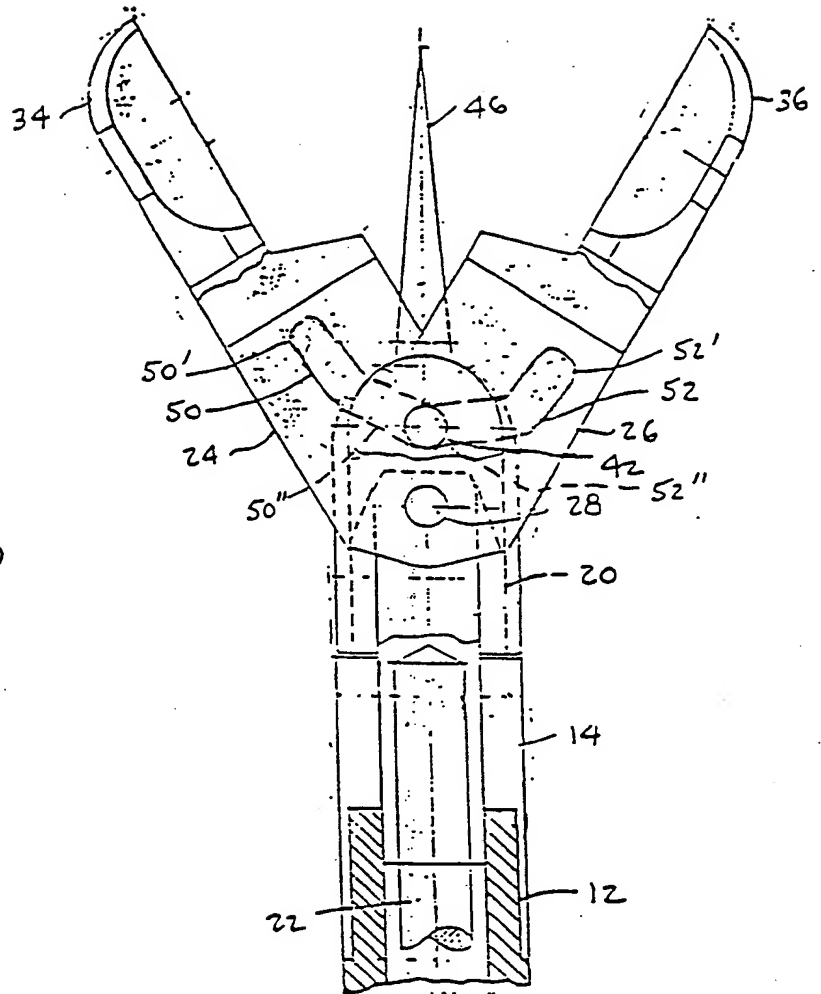


FIG. 4

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC(4) A61B 10/00

US Cl. 128/751

II. FIELDS SEARCHEDMinimum Documentation Searched ⁷

Classification System

Classification Symbols

US

128/4-10,303R,303.1,321,345,749,751
604/22
294/115,116
81/128Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched ⁸**III. DOCUMENTS CONSIDERED TO BE RELEVANT** ⁹

Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
Y	US,A, 3,895,636 (SCHMIDT) 22 July 1975 See entire document.	1-7
A	US,A, 4,151,763 (COLVIN) 01 May 1979 See figure 2; lines 60-69, column 4.	1-7
A	US,A, 4,662,374 (BLAKE, III) 05 May 1987 See figure 4; lines 28-49, column 2.	1-7

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"Δ" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search

09 June 1989

International Searching Authority

ISA/US

Date of Mailing of this International Search Report

17 JUL 1989

Signature of Authorized Officer



William Lewis

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